Random Variables Checkpoint 3

These two questions refer to the following information:

Color-blindness is any abnormality of the color vision system that causes a person to see colors differently than most people, or to have difficulty distinguishing among certain colors (www.visionrx.com).

Color-blindness is gender-based, with the majority of sufferers being males.

Roughly 8% of white males have some form of colorblindness, while the incidence among white females is only 1%.

A random sample of 20 white males and 40 white females was chosen.

Let ***X*** be the number of males (out of the 20) who are color-blind.

Let ***Y*** be the number of females (out of the 40) who are color-blind.

Let ***Z*** be the total number of color-blind individuals in the sample (males and females together).

Question (1)

Which of the following is true about the random variables X, Y, and Z?

A: X is binomial with n = 20 and p = .08.
B: Y is binomial with n = 40 and p = .01.
C: Z is not binomial.
D: All of the above are true.
E: Only (A) and (B) are true.

Feedback

A : 0

✗ This is not quite right. Although this statement is true, there is a better option available. Consider the remaining options. (D) is the right answer.

B : 0

✗ This is not quite right. Although this statement is true, there is a better option available. Consider the remaining options. (D) is the right answer.

C : 0

✗ This is not quite right. Although this statement is true, there is a better option available. Consider the remaining options. (D) is the right answer.

D : 10

✓ Good job! ***X*** represents the number of color-blind males out of a random sample of 20 → ***X*** is binomial with n = 20 and p = 0.08. ***Y*** represents the number of color-blind females out of a random sample of 40 → ***Y*** is also binomial with n = 40 and p = 0.01. ***Z*** represents the total

✓ number of color-blind people out of the total sample of 60. ***Z*** is not binomial, since the probability of "success" (being color-blind) is not the same for all 60 people (0.08 for the 20 males and 0.01 for the 40 females).

E : 0

✗ This is not quite right. Although (A) and (B) are true, they are not the only true statements of all the options. ***Z*** cannot be binomial, because the probability of "success" (being color-blind) is not the same for each trial. There are 20 males with a probability of success of 0.08 and there are 40 females with a probability of success of 0.01. Consider the remaining options. (D) is the right answer.

Question (2)

What is the probability that exactly 2 of the 20 males are color-

blind? (Note: Some answers are rounded.)

A: .08

B: .2711

C: .0143

D: .5422

E: .0159

Feedback

A : 0

✗ This is not quite right. From the previous question, you know that if ***X*** is a random variable representing the number of color-blind white males out of the randomly chosen 20 white males, then ***X*** follows a binomial distribution with n = 20 and p = 0.08. Essentially, this question is asking for P(***X*** = 2). Consider the remaining options. (B) is the right answer.

B : 10

✓ Good job! We need to find P(***X*** = 2) where X is binomial with n = 20 and p = 0.08.

✔ $P(\mathbf{X} = 2) = \frac{20!}{2!(20-2)!} * (0.08)^2 * (1-0.08)^{18} = (\text{calculations...}) = 0.271$

C : 0

✘ This is not quite right. From the previous question, you know that if ***X*** is a random variable representing the number of color-blind white males out of the randomly chosen 20 white males, then ***X*** follows a binomial distribution with n = 20 and p = 0.08. Essentially, this question is asking for P(***X*** = 2). Consider the remaining options. (B) is the right answer.

D : 0

✘ This is not quite right. From the previous question, you know that if ***X*** is a random variable representing the number of color-blind white males out of the randomly chosen 20 white males, then ***X*** follows a binomial distribution with n = 20 and p = 0.08. Essentially, this question is asking for P(***X*** = 2). Consider the remaining options. (B) is the right answer.

E : 0

✗ This is not quite right. From the previous question, you know that if ***X*** is a random variable representing the number of color-blind white males out of the randomly chosen 20 white males, then ***X*** follows a binomial distribution with n = 20 and p = 0.08. Essentially, this question is asking for P(***X*** = 2). Consider the remaining options. (B) is the right answer.